Claims Listing:

1. – 65 (cancelled)

66. (previously presented) A wavelength selective optical device, comprising

a crystal field engineered rare-earth based silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;

a first layer of semiconductor material;

a second layer of semiconductor material, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a wider bandgap than the superlattice; and

a filter coupled to the superlattice.

67. (original) An optical switch, comprising:

a crystal field engineered rare-earth based silicon based superlattice including a plurality of layers that form a plurality of repeating units,wherein at least one of the layers is an active region layer with at least one rare earth ion;

a first layer of semiconductor material;

a second layer of semiconductor material, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a wider bandgap than the superlattice; and

an optical waveguide coupled to the superlattice.

68. (previously presented) An optical device, comprising:

a silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;

a silicon containing layer positioned on a surface of the superlattice;

a first layer of semiconductor material;

a second layer of semiconductor material, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a narrower bandgap than the superlattice; and

at least one transistor positioned on a surface of the silicon containing layer.

69. (currently amended) A nonlinear optical device comprising:

a plurality of adjacent silicon based superlattice structures including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;

a first layer of semiconductor material;

a second layer of semiconductor material, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a wider bandgap than the superlattice; and

wherein each adjacent superlattice structure is gown in an alternating fashion to create a periodic variation in a refractive index

70. (cancelled)

71. (previously presented) An optical receiver, comprising:

at least one p-doped layer;

at least one n- doped layer;

a silicon based superlattice positioned between the at least one p-doped layer and the at least one n-doped layer; the silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;

a first layer of semiconductor material;

a second layer of semiconductor material, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a narrower bandgap than the superlattice; and

at least two electrodes coupled to the at least one p-doped layer and the at least one n-doped layer of p-doped layer.

72. (original) The receiver of claim 71, wherein at least one p-doped layer and the at least one n- doped layer are made substantially of silicon.

73. (previously presented) A semiconductor edge-emitting laser,

first and second reflectors defining a resonator;

a silicon based superlattice positioned between the first and second reflectors, the silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion;

a first layer of semiconductor material;

a second layer of semiconductor material, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a narower bandgap than the superlattice; and

a confinement region that includes at least two electrodes.

74. (original) The laser of claim 73, further comprising:

cleaved or etched facets.

75. (original) The laser of claim 73, wherein the confinement region is positioned in a direction substantially parallel to an optical output direction of the laser.

76. (previously presented) A laser assembly, comprising:

first and second reflectors defining a laser resonator;

a silicon based superlattice positioned between the first and second reflectors, the silicon based superlattice including a plurality of layers that form a plurality of repeating units, wherein at least one of the layers is an active region layer with at least one rare earth ion; wherein the repeating units are periodic, and a period and composition of the repeating units is selected to produce a desired output wavelength;

a first layer of semiconductor material; and

a second layer of semiconductor material, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a wider bandgap than the superlattice; and

77. (original) The assembly of claim 76, wherein the first reflector is a distributed Bragg reflector.

78. (original) The assembly of claim 76, further comprising:

an optical amplifier.

79. (previously presented) A vertical cavity surface emitting semiconductor laser, comprising:

first and second reflectors defining a resonator;

a silicon based superlattice positioned between the first and second reflectors and confined to a substantially circular region whose diameter matches a single mode diameter of the laser, the silicon based superlattice including a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare

earth ion and the repeating units are periodic, with a period and composition of the repeating units selected to produce a desired output wavelength;

a first layer of semiconductor material; and

a second layer of semiconductor material, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a narrower bandgap than the superlattice; and

80. (original) The laser of claim 79, wherein the first reflector is a distributed Bragg reflector.

81. - 104. (cancelled)

105. (currently amended) A ~~photonic device~~ structure, comprising:

a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, wherein at least a portion of the superlattice is made of substantially a Group III-V or II-VI material.

106. (previously presented) A structure for efficient excitation or de-excitation mechanisms of crystal field engineered rare-earth silicon-based superlattice, comprising:

a silicon semiconductor based superlattice that includes a plurality of layers that form a plurality of repeating units, at least one of the layers being an optically active layer with at least one species of rare earth ion;

a first layer of semiconductor material, and

a second layer of semiconductormaterial, wherein the superlattice is sandwiched between the first and second layers and the first and second layers each have a wider bandgap than the superlattice.

107. (cancelled)

108. (previously presented) A silicon semiconductor based superlattice, comprising:

a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, wherein the superlattice forms a portion of a heterojunction bipolar transistor at least a portion of the superlattice being made of substantially a Group III-V or II-VI material,.

109. (currently amended) A silicon semiconductor based superlattice, comprising:

a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, at least a portion of the superlattice being made of substantially a Group III-V or II-VI material, wherein at least a portion of the plurality of layers are interleaved with a plurality of quantum wells.

110. (previously presented) An electrically pumped amplifier, comprising:

a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, wherein the layers are ultra-thin epitaxial layers at least a portion of the superlattice being made of substantially a Group III-V or II-VI material,.

111. (cancelled)

112. (previously presented) A bipolar transistor, comprising:

a collector including a silicon based superlattice with a plurality of layers that form a plurality of repeating units, at least one of the layers being an active region layer with at least one rare earth ion, wherein the superlattice has a miniband injector as an emitter region at least a portion of the superlattice being made of substantially a Group III-V or II-VI material,.

113. (cancelled)